

Thermal Stability of Complex Fuels

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We have developed metrology to assess the “global” thermal stability of complex fuel mixtures such as those found in aviation fuels and kerosene-based rocket fuels. Such fluids are routinely subjected to thermal stress during normal usage; thus, the thermal stability of the fuel must be considered. We use a high temperature, high pressure ampoule technique to thermally stress the fuel. Then we determine the extent of decomposition by analyzing the stressed fluid by a suitable method. Typically, we use gas chromatography with either flame ionization detection or mass spectrometric detection. Separate analyses are done for the liquid and vapor phases of thermally stressed fluid. The “global” kinetics of decomposition is determined by monitoring the increase in a suite of light decomposition products as a function of time. These data are used to derive pseudo-first-order rate constants that approximate the overall decomposition rate of the mixture. We can also couple this method with a mini-scale copper strip corrosion test that assesses the corrosivity of the decomposition products. Such corrosivity is a serious issue in rocket motors, especially if they are re-used. In this poster, measurements will be presented for Jet A, the kerosene-based rocket propellants RP-1 and RP-2, and mixtures of RP-2 with various additives.